

***Appendix C – February 11, 1999 EA Environmental  
Finding***

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**DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION**

**ENVIRONMENTAL FINDING DOCUMENT**

**AGENCY:** Federal Aviation Administration (FAA), DOT

**ACTION:** Environmental Finding Document: Finding No Significant Impact; Notice

**SUMMARY:** The Federal Aviation Administration (FAA) prepared an Environmental Assessment (EA), evaluating a Sea Launch Limited Partnership (SLLP) proposal to construct and operate a mobile, floating launch platform in international waters in the east-central equatorial Pacific Ocean. After reviewing and analyzing currently available data and information on existing conditions, project impacts, and measures to mitigate those impacts, the FAA Associate Administrator for Commercial Space Transportation (AST) finds that licensing the operation of the proposed launch activities is not a major Federal action that would significantly affect the quality of the human environment within the meaning of Executive Order (E.O.) 12114, Environmental Effects Abroad of Major Federal Actions, the application of which is guided by the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an Environmental Impact Statement (EIS) is not required pursuant to E.O. 12114, and AST is issuing an Environmental Finding Document Finding No Significant Impact.

The Environmental Assessment for the Sea Launch Project, dated January 1999, is incorporated by reference and attached to this document. This EA describes the purpose and need for the proposed project and describes the alternatives considered during the preparation of the document. The EA describes the environmental setting and analyzes the impact on the applicable human environment as a consequence of the proposed project.

**FOR A COPY OF THE ENVIRONMENTAL ASSESSMENT FOR THE SEA**

**LAUNCH PROJECT/CONTACT:** Mr. Nikos Himaras, Office of the Associate Administrator for Commercial Space Transportation, Space System Development Division, Suite 331/AST-100, 800 Independence Ave., S.W., Washington, D.C. 20591; phone (202) 267-7926, or refer to the following Internet address: <http://ast.faa.gov>

**ACTION:** If a foreign entity controlled by a U.S. citizen conducts a launch outside the United States and outside the territory of a foreign country, its launch must be licensed. 49 U.S.C. § 70104(a)(3). The FAA determined that SLLP is a foreign entity controlled by a U.S. citizen, Boeing Commercial Space Company. 49 U.S.C. § 70102(1)(C); 14 CFR § 401.5. Because SLLP proposes to launch in international waters, outside the territory of the United States or a foreign country, SLLP must obtain an FAA license to launch. Licensing a launch in the environment outside the United States, its territories, and possessions is a Federal action requiring environmental analysis by the FAA in accordance with E.O. 12114 the application of which is guided by the National Environmental Policy Act of 1969. Upon receipt of a completed license application, the Associate Administrator for Commercial Space Transportation must determine whether or not to issue a license to SLLP to launch. Environmental findings are required for a license evaluation. In this instance, the proposed action is the licensing by the FAA of two launches by the SLLP at the specified launch location. The environmental finding and analysis covers up to six launches per year. SLLP proposes to conduct three (3) launches in the first year of operation. Pursuant to its requirements, the FAA will reevaluate the adequacy of existing environmental documentation if new circumstances develop.

SLLP proposes to conduct commercial space launch operations from a mobile, floating platform in international waters in the east-central equatorial Pacific Ocean. The SLLP is an international commercial venture formed to launch commercial satellites. It is organized under the laws of the Cayman Islands, BWI, and the partnership members are Boeing Commercial Space Company of the United States; RSC Energia of Russia; KB Yuzhnoye of the Ukraine; and Kvaerner Maritime a.s of Norway.

The SLLP would use a launch platform (LP) and an assembly and command ship (ACS). A floating oil drilling platform was refurbished in Norway to serve as the self-propelled LP. The ACS was built in Scotland specifically for Sea Launch operations.

A Zenit-3SL expendable launch vehicle fueled by kerosene and liquid oxygen would be the only launch vehicle used at the Sea Launch facilities. In the first year of operation, SLLP intends to conduct three (3) launches. Six launches are proposed for each subsequent year. The launches are proposed to occur at the equator in the vicinity of 154 degrees west to maximize inertial and other launch

efficiencies. The distances from South America (over 7,000 km) and from the nearest inhabited island, Kiritimati (Christmas Island), (340 km) are intended to ensure that Stage 1 and Stage 2 would drop well away from land, coastal populated areas, and exclusive economic zones.

The FAA evaluated open sea areas, the Kiribati Islands, the Galapagos Islands and used a U.S. Navy environmental analysis of the Home Port in Long Beach, California in assessing potential environmental impacts from the proposed launch activities. This FAA environmental study incorporates by reference an environmental assessment conducted by the Navy on the Home Port Facility, which EA resulted in 1996 in a Finding of No Significant Impact. The Navy environmental assessment, also known as the Navy Mole EA, covers SLLP Home Port activities. This FAA environmental study focused on Sea Launch activities conducted at the launch location, activities that may impact the launch range during normal launches, and failed missions. Sea Launch payloads (i.e., commercial satellites) are not included in this evaluation because they will be fueled and sealed at the Home Port and will only become operational at an altitude of over 35,000 km. Potential environmental impacts of payloads are not discussed here except with regard to failed mission scenarios.

## **ENVIRONMENTAL IMPACTS**

### **Air Quality**

Pre-launch activities that may impact air quality include LP and ACS positioning, final equipment and process checks, coupling of fuel lines to the integrated launch vehicle (ILV) prior to fueling, the transfer of kerosene and liquid oxygen (LOX) fuels, and decoupling of the fueling apparatus. Normal launch operations would result only in an incidental loss of kerosene and LOX in vapor form. This loss of vapors would dissipate immediately and form smog. Although unlikely, an unsuccessful ignition attempt would result in automatic defueling of the ILV. Defueling would release LOX vapor and approximately 70 kg of kerosene when the fuel line is flushed. The LOX would dissipate and the vapor and kerosene would evaporate rapidly, dissipate and degrade, thereby having little effect on the surrounding environment. The probability of an unsuccessful ignition attempt resulting in defueling is  $4 \times 10^{-4}$ .

Potential environmental impacts from launch and flight activities would include spent stages, residual fuels, combustion emissions, and thermal energy and noise released

into the atmosphere and ocean. During normal launches, any impacts would be distributed across the east-central equatorial Pacific region in a predictable manner. Kerosene released during descent of a failed launch attempt would evaporate within minutes. Any residual LOX released during a failed launch attempt would instantly evaporate without consequence.

The proposed launch site is relatively free of combustion source emissions. That fact coupled with the size of the Pacific Ocean and air space allows most launch emissions to dissipate rapidly. Launch effects on the boundary layer up to 2,000 meters would be short term and cause minimal impacts. Emissions occurring in the atmospheric boundary layer would be dispersed away from the islands by winds and local turbulence caused by solar heating. Because dispersion occurs within hours, the planned six missions per year would preclude cumulative effects.

All emissions to the troposphere would come from first stage combustion of LOX and kerosene. Photochemical reactions involving Sea Launch Zenit rocket emissions would form carbon dioxide (CO<sub>2</sub>) and oxygenated organic compounds. Nitrogen oxide in the exhaust trail would form nitric and nitrous acids. Cloud droplets and atmospheric aerosols efficiently absorb water-soluble compounds such as acids, oxygenated chemical compounds, and oxidants, thereby reducing impacts to insignificant levels.

Approximately 36,100 kg of carbon monoxide (CO) would be released into the troposphere during the first 55 seconds of flight resulting in an estimated CO concentration at Christmas Island of 9.94 mg/m<sup>3</sup>. This release is well below the Occupational Safety and Health Administration Permissible Exposure Limit (PEL) of 55 mg/m<sup>3</sup>, the Environmental Protection Agency (EPA) level of concern of 175 mg/m<sup>3</sup> and the industry Emergency Response Planning Guideline-2 of 400 mg/m<sup>3</sup>. Nitrogen compounds in the exhaust trail of liquid propellant rockets would cause a temporary reduction of atmospheric ozone, with return to near background levels within a few hours. Models and measurement of other space systems comparable to Sea Launch indicate that these impacts would be temporary, and the atmosphere is capable of replacing the destroyed ozone within a few hours by migration or regeneration. The high-speed movement of the Zenit-3SL rocket and the re-entry of the stages after their use may impact stratospheric ozone. The exact chemistry and relative significance of these processes are not known but are believed to be minimal.

Impacts to air quality would be minimal. Those impacts that do occur would be of short duration and would naturally reverse themselves over a short period of time.

## **Waste**

Post-launch operations at the launch site involve cleaning the LP for subsequent launches. Cleaning would result in particulate residues being washed from the LP with fresh water. Only a few kilograms of debris and residues would be generated. These materials would be collected and handled onboard as solid waste for later disposal at the Home Port. Impact locations for the spent rocket stages would be the open ocean. The current descriptions of the ocean environment, including physical, chemical and biological processes, apply equally to the launch location and the approximate locations of spent stage impacts. Nutrient and biological productivity levels are largely equivalent (in statistical terms) at the launch location and points further east where Stage 1 and Stage 2 fall; one has to be much closer to the Galapagos Islands to find meaningfully higher levels of productivity and biological activity.

## **Noise**

Noise from a launch is calculated at approximately 150 decibels at 378 meters with the equivalent sound intensity in the water estimated at less than 75 decibels. Due to the small number of launches per year and scarcity of higher trophic level organisms, noise impacts are expected to be negligible.

## **Biological and Ecological Impacts**

Pre-launch preparations includes spraying fresh water from a tank on the LP into the LP's flame bucket, which would dissipate heat and absorb sound during the initial fuel burn. There would be minor impacts to the ecosystem because of the input of heated freshwater. However, the natural variation in plankton densities would ensure rapid and timely recolonization of plankton in the water surrounding the LP.

Launch and flight activities may impact the ocean environment by depositing spent stages and residual fuels. During normal launches, these impacts would occur and be distributed across the east-central equatorial pacific region. It is unlikely that any falling debris would impact animals, although a small number of marine organisms would be impacted. Plankton immediately beneath any kerosene

sheen would likely be killed. However, overall plankton mortality would be minimal as the population densities are greatest around 30 meters below the surface. Fuel dispersed from Stages 1 and 2 would evaporate in minutes and within a few thousand feet, as in the case when a pilot lightens a plane by dumping jet fuel. The small amount of kerosene that might reach the ocean surface would evaporate and decompose within hours.

Two severe accident scenarios were evaluated and determined to cause only minimal damage to the environment. The first case evaluated ILV failure and explosion on the LP with the ILV being fully fueled and ready for launch. This failure would result in an explosion of the ILV fuels scattering pieces of the ILV and LP up to 3 km away. Particulate matter from the smoke plume would drift downwind and be distributed a few kilometers before dissipating. Plankton and fish in the immediate area would be killed over the course of several days. Thermal energy would be deflected and absorbed by the ocean and 100% of the fuels would be consumed or released into the atmosphere through combustion or evaporation. Disruption to the atmosphere and the ocean would be assimilated and the environment would return to pre-accident conditions within several days.

The second scenario evaluated involved failure of the rocket's upper stage. Loss and re-entry of the upper stage and payload would result in materials and fuels being heated by friction and vaporizing. Remaining objects would fall into the ocean causing a temporary disruption as the warm objects cooled and sank. The risk of debris striking any populated areas or ecological habitats is very remote. Sea Launch selected a more northerly route to further reduce the risk to the Galapagos Islands. The risk of an impact to either Wolf or Darwin Islands would only occur in the unlikely event of a scenario in which Stage 3 (the upper stage) suffers a specific type of failure during two specific time intervals of around .25 second each. In the event of mid-flight Stage 3 failure, approximately 99% of the satellite and its components would burn up upon re-entry to the atmosphere. Thus, the total mass of any objects reaching Wolf or Darwin Islands would be small. The probability of this occurring is approximately 8 in 100,000 launches.

### **Socioeconomics**

The SLLP would occupy the launch location for two to seven days during each launch cycle. Due to the brief period of time that the LP and the ACS will be present at the launch



location, social and economic impacts to the Kiribati are considered negligible. The brief duration of launch activities, and the relative degree of isolation of the launch location provides a barrier between Sea Launch and cultural and economic character of the Kiribati society. The baseline plan for operations does not include any use of facilities based on any of the Kiribati Islands. Impacts to the Islands, associated with employees transiting Christmas Island on an emergency basis, would be positive given that the expenditures would be an addition to the local economy.

## **Health and Safety**

FAA's licensing process will examine safety aspects of the proposed launch operations.

The SLLP adopted as a population protection risk criteria, an upper limit of one in a million casualty expectation. Public safety assurance and analysis issues are discussed in the SLLP document "Sea Launch System Safety Plan." The launch location was shifted away from South America to ensure that Stage 1, the fairing, and Stage 2 would drop well away from land and coastal commercial activity. The instantaneous impact point speed would increase over South America, decreasing the dwell time and potential risk as the rocket traverses land. The launch area, in the vicinity of 154 degrees west was selected because it is located outside of the Kiribati 320 km exclusive economic zone and is roughly 340 km from the nearest inhabited island.

## **Threatened and Endangered Species**

There are no known threatened and endangered species that will be impacted by the proposed launches.

## **Archeological and Cultural Resources**

The launches, proposed to occur in the open ocean, will not impact archeological or cultural resources.

## **Cumulative Impacts**

There are no other foreseeable planned developments in the area of the proposed launch location at this time, therefore, no expected cumulative impacts are expected. The Navy Mole facility is currently underutilized as compared to its historical level of operation and development. Sea Launch activities will generate additional work and revenue and the Home Port facility may be the impetus for other development in the area.

## **Other Environmental Considerations**

### **Home Port**

The design, permitting, construction, and operation of the Home Port would be managed under the jurisdiction of the state, regional, county, municipal, and port authorities of the Port of Long Beach, California. The Navy, as part of the California Environmental Quality Act Process, submitted its Mole EA to the California Coastal Commission for review, which determined the proposed Home Port activities were not inconsistent with the California Coastal Zone Management Program. The Port of Long Beach has approved the construction and operation of the Home Port through the Harbor Development Permit process. One of the standard conditions in the Harbor Development Permit is that SLLP will follow all applicable Federal, state, and local laws and regulations, including those pertaining to safety and environment. The LP, ACS, and satellite tracking ships used to transport the launch vehicle, payload and other materials to the launch site and operate the launch will be subject to and will comply with all applicable environmental and maritime international agreement requirements while traveling to and from, and while at the launch site.

### **Notice to Mariners**

Standard notices to mariners will be broadcast using U.S. Government protocols via INMARSAT-C in the Pacific Ocean Region on Safety Net channel at 1000 – 1030 and 2200 – 2230 hours GMT each day starting 5 days prior to each launch. For vessels without INMARSAT-C transceivers, the notice will be broadcast in the HF band by U.S. Coast Guard, Honolulu. For vessels without any receiving equipment (expected to be limited to those operating out of Kiribati ports), the standard notice will be delivered by fax or mail services to Kiribati government authorities and fishing fleet and tour operators for distribution and posting.

### **Environmental Monitoring Plan**

The Environmental Monitoring and Protection Plan is being developed as an integral part of Sea Launch plans for operations at sea, and its implementation involves the participation of both aerospace and marine crews. FAA approval of the Environmental Monitoring Plan is a condition of the launch license. The Plan consists of four elements:

- Visual observation for species of concern
- Remote detection of atmospheric effects during launch
- Surface water samples to detect possible launch effects
- Notices to local mariners

A separate plan exists for each element to direct specific actions and coordinate the analysis of acquired data.

### **Public Participation**

During the planning phase of the Sea Launch environmental review process, the FAA concluded that public participation was required. It was further decided that the Environmental Assessment and proposed finding document would be made available for public review for a 30-day period. Consequently a list of pertinent entities was compiled to ensure that wide distribution of the documents would be possible. The list included cognizant Federal and State agencies, scientific institutes, trade and environmental organizations and foreign embassies of countries in the area of the proposed action. The documents would also be made available to any organization or member of the public and could also be found in the FAA/AST web site. The public review period commenced on April 23, 1998 via publication of a Notice in the Federal Register. During the week preceding this announcement, FAA mailed copies of the documents to all entities on the list. Additional copies were mailed via regular or next-day mail, as requested. The public review and comment period was scheduled from April 23, 1998 until May 26, 1998.

Interest in the project was expressed by a number of South Pacific Nations, Ecuador and the South Pacific Regional Environmental Programme (SPREP). These entities also indicated the need for additional time for internal coordination and consultation. In response to this need, the FAA accepted and addressed all review comments, which arrived after the end of the scheduled public review and comment period.

As part of the public participation program, FAA/AST personnel held face-to-face information exchanges with representatives of Ecuador in Washington DC. In addition, FAA personnel traveled to the Western Pacific and held similar meetings with representatives of the Republic of Kiribati at Tarawa and with SPREP representatives at Apia, Samoa. Diplomatic representatives from Australia and New

Zealand participated at the Apia meeting and Australian representatives met with the FAA in Washington, DC.

Numerous meetings, and information exchanges also took place among FAA/AST personnel and specialists from the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Environmental Protection Agency (EPA), National Air and Space Administration (NASA), United States Coast Guard (USCG) and the Department of State (DOS).

The FAA is also making available to the public the Final Sea Launch Environmental Assessment and Environmental Finding Document.

### **No Action Alternative**

Under the No Action alternative the SLLP would not launch satellites from the Pacific Ocean and the Port of Long Beach would remain available for other commercial or government ventures. The goals of 49 U.S.C. Subtitle IX, ch. 701 Commercial Space Launch Activities, would not be realized. Predicted environmental impacts of the proposed launch activities would not occur and the project area would remain in its current state.

Prepared by \_\_\_\_\_ Date \_\_\_\_\_  
Nikos Himaras

Recommended by \_\_\_\_\_ Date \_\_\_\_\_  
Herb Bachner

## **FINDING**

An analysis of the action has concluded that there are no significant short-term or long-term effects to the environment or surrounding populations. After careful and thorough consideration of the facts contained herein, the undersigned finds that the proposed Federal action is consistent with the purpose of national environmental policies and objectives as set forth in E.O. 12114 the application of which is guided by the National Environmental Policy Act of 1969 (NEPA) and that it will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation. Therefore, an Environmental Impact Statement for the action is not required.

Issued in Washington, DC on:\_\_\_\_\_

Patricia G. Smith \_\_\_\_\_  
Associate Administrator for Commercial Space Transportation.

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